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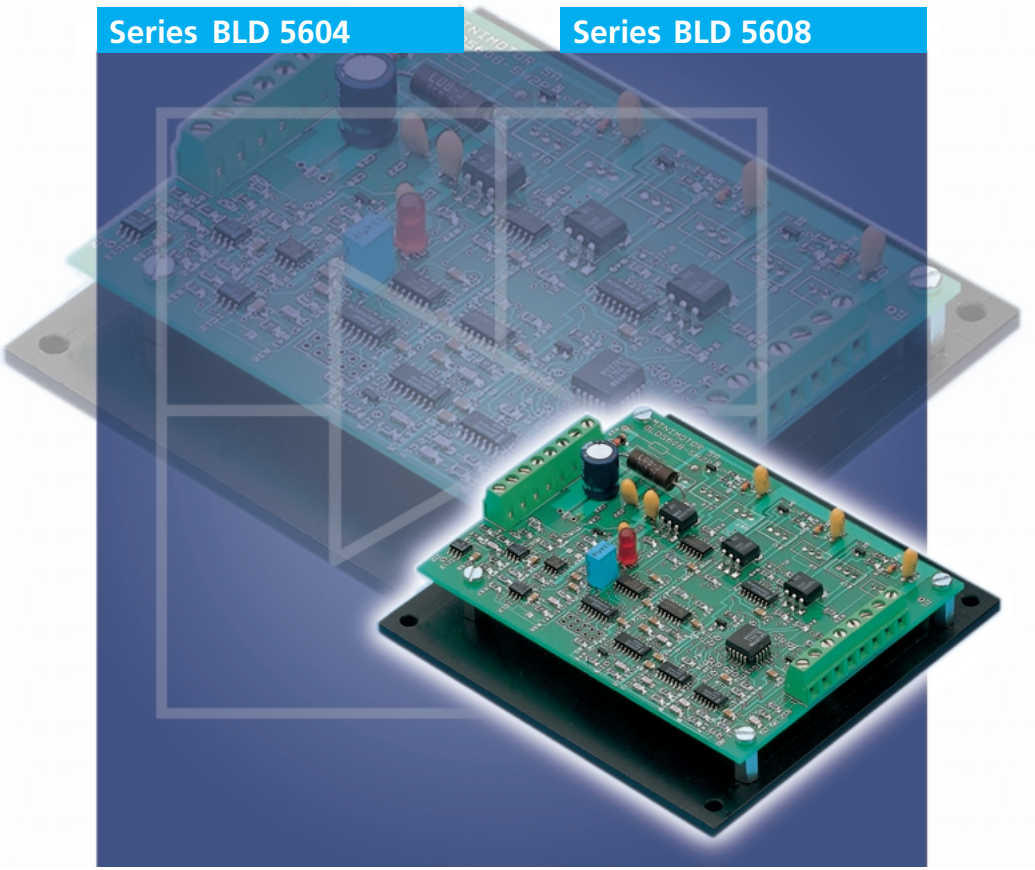
Motion Controller

2-Quadrant PWM for Brushless DC-Servomotors



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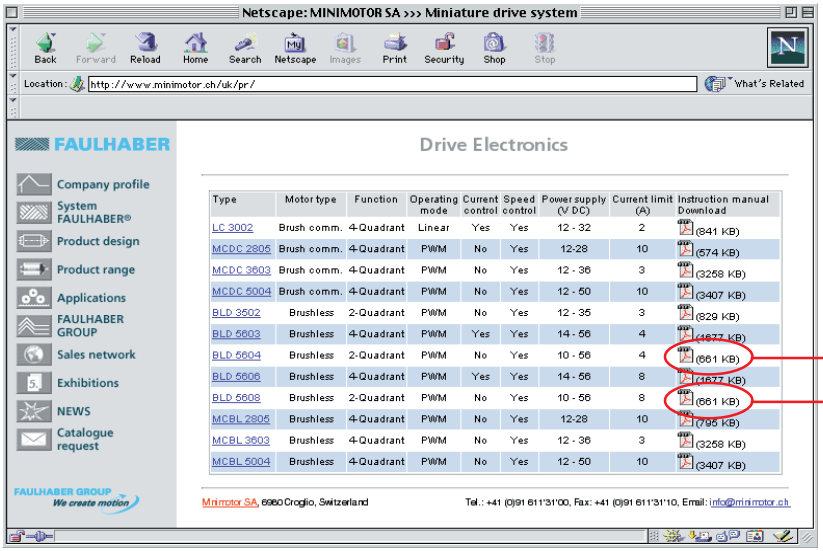
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Type | Motor type | Function | Operating mode | Current control | Speed control | Power supply (V DC) | Current limit (A) | Instruction manual Download
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BLD 5606 | Brushless | 4-Quadrant | PWM | Yes | Yes | 14 - 56 | 8 | (1677 KB)
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General information

1. Description

The BLD 5604 and the BLD 5608 are 2-quadrant PWM (Pulse-Width Modulation) servo amplifiers ideal for the speed control of our three-phase brushless DC-servomotors:

- 5604 for motor types 1628, 2036 and 2444;
- 5608 for motor types 3056 and 3564.

The commutation sequence of the servomotor phases is made electronically by the servo amplifier. A specially designed frequency-to-voltage converter allows precise speed regulation via the Hall sensors without the need of an encoder (regulator type PI, proportional plus integral). The combination of MOSFET power stage and PWM technologies enables both compact design and high power efficiency.
Both amplifiers are provided with thermal and motor stall protection and pulse-by-pulse current limitation.
For the BLD 5604-SH2P the current limit is set to 4A; without additional heat sink, the maximum continuous output power is 150W.
The BLD 5608-SH2P is set to 8A ; the maximum continuous output power is 250 W.

2. Illustration

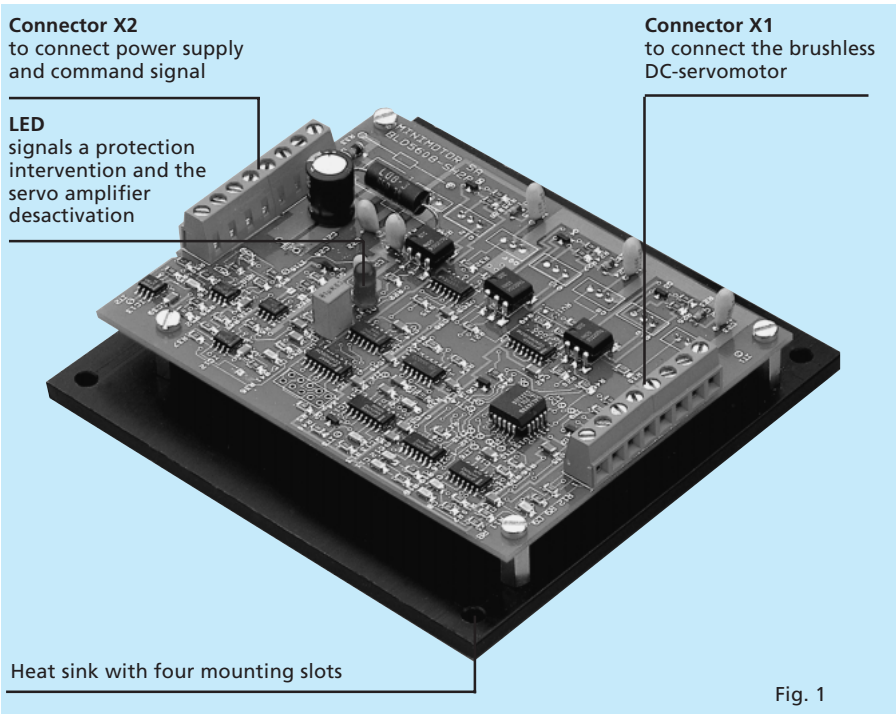


Fig. 1

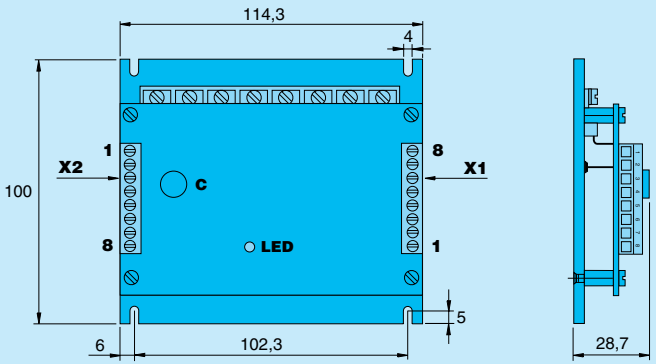
Technical data

3. Maximum ratings	5604-SH2P	5608-SH2P	
Power supply	60	60	V DC
Analog and logical inputs	–0,3 to 5	–0,3 to 5	V DC
Voltage for the pull-up fault output			
(8 mA max. sink current)	12	12	V DC
Continuous output current @ T_A = 22°C	3	5	A

4. Specific characteristics			
Power supply	10 ÷ 56	10 ÷ 56	V DC
PWM switching frequency	25	25	kHz
Current limit (pulse-by-pulse current limiting)	4	8	A
Total standby current,			
Hall-effect sensors supply included	120	120	mA
Efficiency max.	95	95	%
Analog speed command: (1)			
- voltage range	0 ÷ 5	0 ÷ 5	V DC
- frequency bandwidth	10	10	Hz
- input impedance	460	460	kΩ
Logic inputs	TTL	TTL	V DC
Output voltage for external use (100 mA max. load)	5	5	V DC
Speed gain	12 000	6 000	rpm/V
Maximum controllable speed (2)	60 000	30 000	rpm
Minimum controllable speed (3)	800	800	rpm
Operating temperature range	0 ... + 70	0 ... + 70	°C
Storage temperature range	–20 ... +120	–20 ... +120	°C

1) analog speed command may be set by an external potentiometer or an external voltage
2) the maximum speed depends on the power supply, the motor type and the load
3) the minimum speed depends on the motor type, the inertia and the viscous friction of the load

5. Dimensions and weight



Scale reduced

Dimensions
length 114,3 mm
width 100 mm
height 28,7 mm

Weight 200 g

Fig. 2

Specifications subject to change without notice

General characteristics

6. General characteristics

6.1 Analog speed command

The speed command is given by an external voltage from 0 to 5V or by a potentiometer connected directly to the servo amplifier (see fig. 4).
The total potentiometer resistance must be between 10 kΩ and 47 kΩ.
Furthermore, a PWM signal with a maximum amplitude of 5V and a minimum frequency of 1 kHz can be used as a speed command.

6.2 Speed regulator, type PI

A Proportional plus Integral (PI) speed regulator controls a brushless DC-servomotor with no steady-state error (step input command).

6.3 Direction

The direction of rotation is changed using either a high or low input signal (TTL compatible).
When a high input signal is given or the input is unconnected (internal pull-up resistance), the motor turns in the clockwise direction (CW).
When a low input command is given or the input is connected to GND, the motor turns in the counterclockwise direction (CCW).

6.4 $\overline{\text{Brake}}$

This feature allows the motor to brake dynamically by applying a low input signal to the $\overline{\text{BRAKE}}$ input.
The braking torque is proportional to the speed: **at standstill, there is no torque applied to the motor**. This logical input also has the function to reset the servo amplifier when an error message is given via the red LED.
We recommend using this feature at speeds below 10 000 rpm.

6.5 Protection against motor stall

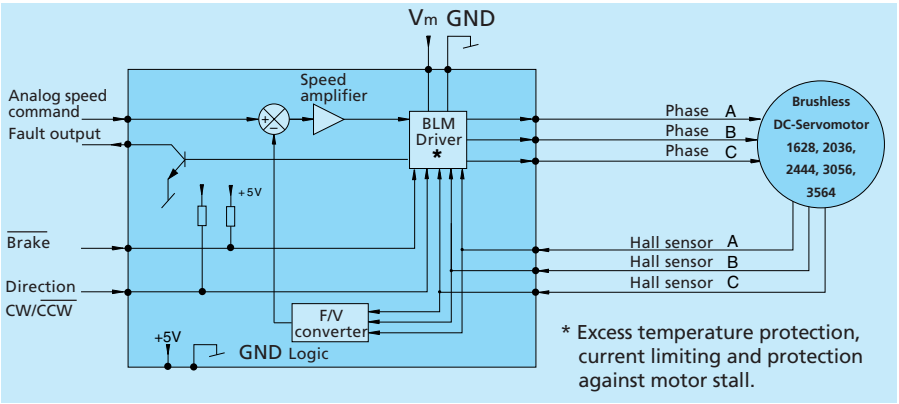
This protection is a special feature to preserve the motor in case of mechanical blocking or motor stall. The servo amplifier will be disactivated after few seconds, when the motor is powered, it does not turn.
At the same time this intervention will be signalled by the red LED and with the activation of the Fault Output (open-collector). To reset and reactivate the servo amplifier it is necessary to turn the $\overline{\text{BRAKE}}$ input low and then high.

6.6 Excess temperature protection

The servo amplifier automatically shuts off if the heat sink temperature exceeds +75 °C.
When the temperature is below +70 °C the servo amplifier can be restarted with the $\overline{\text{BRAKE}}$ input.

Start-up procedure

6.7 Basic circuit diagram

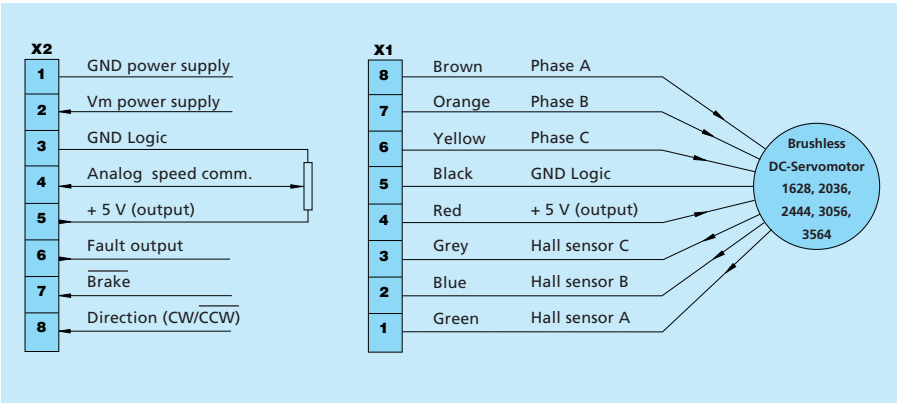


7. Start-up procedure

7.1 Procedure

- Connect the servo amplifier according to the diagram (see fig. 4)
- Only switch on the power once all wires have been connected
- Verify the operation; if the red LED is on then check the connections and reset via the BRAKE input.

7.2 Connection diagram



Specifications subject to change without notice

Notice of use

8. Notice of use

8.1 Power supply

Any unstabilized power supply voltage within the servo amplifier range (10V ≤ Vm ≤ 56 V) may be used, although it is advisable to keep this voltage as low as possible in order to minimize the electromagnetic interferences (EMI).

Thus the optimum power supply is given by the following relation:

$$V_m\,[V] \approx 5\,[V] + R\,[\Omega] \cdot I_{max}\,[A] + k_E\,[V/rpm] \cdot n_{max}\,[rpm]$$

with R : terminal resistance of the motor phases;
kE : back-EMF constant of the motor;
Imax : maximum current reached by the motor in your specific application;
nmax : maximum speed reached by the motor in your specific application.

8.2 Wiring

A well known disadvantage of pulse-width modulation, is the large amount of interferences generated. This has two consequences, namely perturbations to the environment and self perturbations.
The EMI are generated in the motor power leads and induced in the Hall-effect sensor wires. The smooth running of the motor is therefore perturbed and even in some cases, the motor will not run at all.

In order to reduce the effect of these perturbations, there are some basic rules to follow:

- use wires as short as possible;
- avoid to run signal wires (logical and analog command, Hall-effect sensors signals) in close proximity to power lead wires (power supply and servomotor phases);
- connect shielded wires to ground at one end only to avoid ground loops.

A special care should be given to the motor connection. The following table summarizes the different solutions:

Notice of use

Action	To	From	Self	Length
1. No special care	no	no	no	0.3 m
2. Twisted wires (see fig. 5)	slightly	slightly	slightly	1.0 m
3. Shielded Hall-effect sensor wires (see fig. 6)	no	yes	yes	5.0 m
4. Shielded Hall-effect sensor and phases wires (see fig. 7)	yes	yes	yes	5.0 m

with To: perturbations to environment reduced
From: perturbations from environment reduced
Self: self perturbations reduced
Length: maximum cable length

In case of wires longer than the standard product (0,3 m) it is recommended to use the following cable sections:

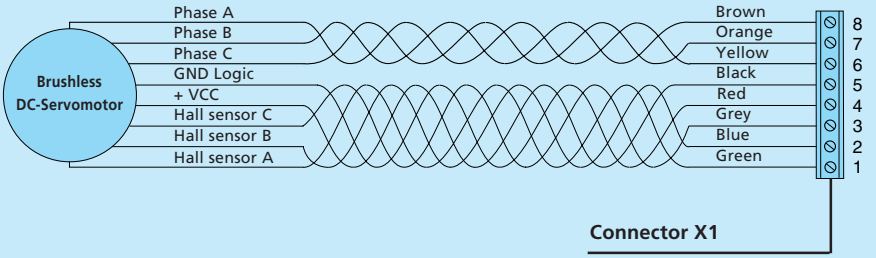
Phase, DC-Servomotor type 1628 ... B: 0,5 mm² / AWG 20
Phase, DC-Servomotor type 2036 ... B: 1,0 mm² / AWG 18
Phase, DC-Servomotor type 2444 ... B: 1,0 mm² / AWG 18
Phase, DC-Servomotor type 3056 ... B: 1,5 mm² / AWG 16
Phase, DC-Servomotor type 3564 ... B: 1,5 mm² / AWG 16

Hall-effect sensors, all DC-Servomotor types: 0,5 mm² / AWG 20

Note: If wires are longer than 5 m please consult us.

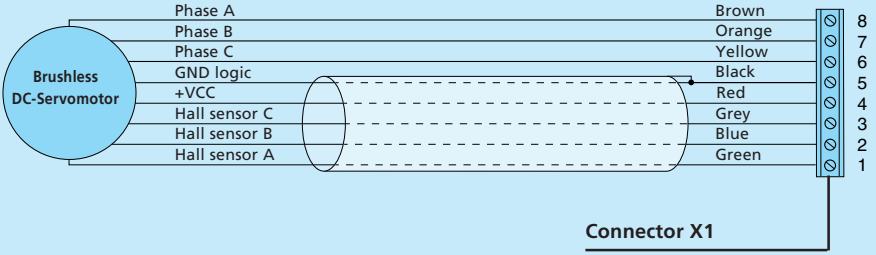
Twisted wires

Figure 5



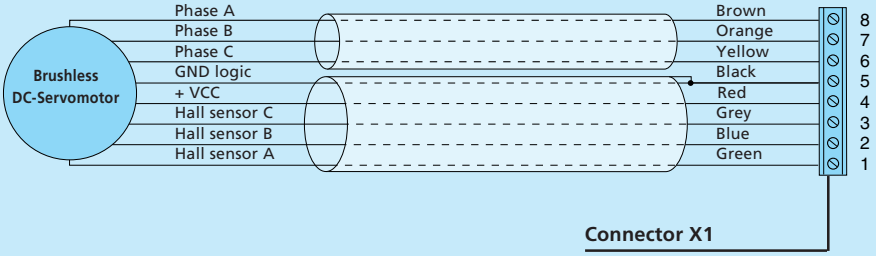
Shielded Hall sensor wires

Figure 6



Shielded phase and Hall sensor wires

Figure 7



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